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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/586,606	07/19/2006	Yasuhiro Toida	8062-1039	5951
466 7590 04/19/2010 YOUNG & THOMPSON 209 Madison Street Suite 500 Alexandria, VA 22314				
EXAMINER ROBINSON, RENEE E				
ART UNIT		PAPER NUMBER		
1797				
NOTIFICATION DATE		DELIVERY MODE		
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

DocketingDept@young-thompson.com

Office Action Summary

Application No.

10/586,606

Applicant(s)

TODA, YASUHIRO

Examiner

RENEE ROBINSON

Art Unit

1797

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 January 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 9, 11-14, 18 and 19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 9, 11-14, 18 and 19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB-06)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. Amendment to claims 1-3 and 9; and cancellation of claims 5-8, 10, 15-17 and 20 is noted.
2. Due to amendments to the claims, the previous rejection is withdrawn. New rejection follows. Examiner's response to the arguments follows the rejection.
3. In addition, the obviousness-type double patenting rejection in the previous action is withdrawn due to amendments to the pending claims.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 1, 2, 4, 11-14 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toida (WO 2003/097771). Hereinafter, the WIPO document is cited from the English translation, US 2005/0173297.

7. Regarding claim 1, Toida discloses a method for desulfurizing hydrocarbon oils comprising bringing a hydrocarbon oil containing at least one sulfur compound selected from the group consisting of thiophene compounds, benzothiophene compounds, and dibenzothiophene compounds or a hydrocarbon oil further containing aromatic hydrocarbons into contact with a zeolite selected from the group consisting of proton-type faujasite zeolite, proton-type mordenite, and proton-type β -zeolite, and having a silica/alumina ratio of less than 100 mol/mol (i.e. not more than 10 mol/mol for faujasite and not more than 20 mol/mol for mordenite) (see p. 2, par. 0012 and 0014; p. 7, par. 0084-0086).

8. Toida does not expressly disclose that the content of cations other than proton in the faujasite zeolite, mordenite, and β -zeolite is 5 mass% or less. However, Toida teaches that the amount of protons in the solid acid zeolite affects the molar ratio of $\text{SiO}_2/\text{AlO}_4$, the acid strength, and the solid acid amount (p. 7, par. 0085). Therefore, the exact content of protons of the solid acid zeolite component is deemed to be a result effective variable with regard to the molar ratio of $\text{SiO}_2/\text{AlO}_4$, the acid strength, and the solid acid amount. It would require routine experimentation to determine the optimum value of a result effective variable, such as the exact content of protons, in the absence of a showing of criticality in the claimed proton (or cation) content. *In re Boesch*, 205 USPQ 215 (CCPA 1980), *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

One of ordinary skill in the art would have been motivated by Toida to optimize the content of protons in the solid acid zeolite in order to provide an adsorptive desulfurization agent which provides the maximum adsorption of undesirable sulfur compounds.

9. Toida does not expressly disclose bringing the hydrocarbon oil into contact with a solid superacid catalyst selected from the group consisting of sulfated zirconia, sulfated alumina, sulfated tin oxide, sulfated iron oxide, tungstated zirconia, and tungstated tin oxide. Nevertheless, Toida teaches and/or suggests all limitations required by claim 1 since the claim language specifically states "contact with a zeolite...and/or a solid superacid catalyst", which encompasses an embodiment in which the hydrocarbon oil is brought into contact with a zeolite from the selected group and does not require a solid superacid catalyst.

10. Regarding claim 2, Toida discloses that the hydrocarbon oil further contains aromatic hydrocarbons and sulfur compounds contained in the hydrocarbon oil are reacted among themselves and/or with the aromatic hydrocarbons by bringing the hydrocarbon oil into contact with the solid acid catalyst (p. 7, par. 0088).

11. Regarding claims 4 and 18, Toida teaches reducing the sulfur content of the hydrocarbon oils to 1 ppm or less (not more than 1 ppm) (p. 12, par. 0119).

12. Regarding claim 11, Toida discloses that the hydrocarbon oil contains aromatic hydrocarbons as major components (p. 1, par. 0006-0007; p. 2, par. 0019; p. 7, par. 0088; Table 4).

13. Regarding claim 12, Toida discloses that the aromatic hydrocarbons include toluene (alkylbenzene having 7 carbon atoms) and aromatic compounds with two rings (naphthalene) (p. 2, par. 0019; p. 7, par. 0088).

14. Regarding claim 13, Toida teaches that the hydrocarbon oil is kerosene or gas oil (p. 2, par. 0018; p. 8, par. 0094).

15. Regarding claim 14, Toida teaches that the kerosene and gas oil may be demanded as a result of the widespread use of the fuel cell for automobiles or the like which carry the fuel cell of the onboard reforming type (p. 1, par. 0002; p. 8, par. 0094). Therefore, while Toida does not expressly disclose that the kerosene or gas oil is desulfurized in the fuel cell vehicle, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to implement the desulfurization process of Toida in a fuel cell vehicle as claimed since Toida expressly suggests the high demand for low sulfur fuel for onboard reforming fuel cells.

16. Claims 3, 9 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toida (WO 2003/097771) in view of Imura et al (EP 1 142 636). Hereinafter, the WIPO document (Toida) is cited from the English translation, US 2005/0173297.

17. Toida is relied upon as set forth above in the rejection of claims 1 and 2.

18. Regarding claim 3, Toida discloses that the sulfur compounds in the hydrocarbon oil and heavy sulfur compounds produced by the reaction among the sulfur compounds contained in the hydrocarbon oil and/or by the reaction of the sulfur compounds with aromatic compounds are adsorbed by the adsorptive desulfurization agent (i.e. the

zeolite) (p. 2, par. 0012-0015; p. 7, par. 0084-0086). However, Toida does not explicitly disclose a solid superacid catalyst and therefore also does not disclose a solid superacid catalyst having a specific surface area of $100 \text{ m}^2/\text{g}$ or more, as per claim 9.

19. Imura teaches desulfurizing a light hydrocarbon oil by contacting the hydrocarbon oil with a superstrong acid catalyst comprising zirconium oxide (zirconia) and from 1 to 3 wt% sulfuric acid radicals (i.e. SO_4 or sulfate) (Abstract; p. 3, par. 0012 and 0017). Imura discloses examples in which the specific surface area of the catalyst is greater than $100 \text{ m}^2/\text{g}$ (see Table 1). Imura teaches that the disclosed solid acid catalyst has activity in both hydrocarbon isomerization and desulfurization of organosulfur compounds, wherein isomerization of the hydrocarbon oil improves the octane number of the fuel, thereby improving engine performance in motor vehicles and aircraft (p. 2, par. 0002 and 0007).

20. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the process of Toida by using a solid acid catalyst comprising a sulfated zirconia with a specific surface area of greater than $100 \text{ m}^2/\text{g}$, as suggested by Imura, in order to provide both isomerization and desulfurization capabilities, thereby providing a fuel with a lower sulfur content and an improved octane number.

21. Further regarding claim 3, like Toida, Imura discloses that the catalyst is suitable for removing thiophene compounds (see p. 6, par. 0043-0045). Therefore, in modifying Toida with Imura, the solid superacid catalyst would be expected to contribute to the adsorption of the sulfur compounds in the hydrocarbon oil and the heavy sulfur

compounds produced by the reaction of the sulfur compounds with themselves and with the aromatic compounds. Accordingly, the limitations of claim 3 are not considered to patentably distinguish the instant process from Toida in view of Imura.

22. Regarding claim 19, Toida teaches reducing the sulfur content of the hydrocarbon oils to 1 ppm or less (not more than 1 ppm) (p. 12, par. 0119).

Response to Arguments

23. Applicant's arguments filed 26 January 2010 have been fully considered but they are not persuasive.

24. Applicant argues that claim 1 limits the zeolite to the proton-type zeolite which has a content of cations other than protons of 5 mass % or less and that this is not taught or suggested by the prior art. Applicant submits that Toida discloses that non-proton-type zeolite is preferable.

25. This argument is not found persuasive because the claim does not necessarily require a given proton content. Instead, the claimed "content of cations other than protons of 5 mass % or less" merely limits the content of *cations other than protons* on the catalyst. Accordingly, the claim could encompass a catalyst comprising less than 5 mass % of cations other than protons and some amount of protons (H⁺). Paragraph [0122] of Toida discloses H mordenite and H Y zeolite, among others, as known sulfur adsorbent. In addition, Examiner provided motivation for altering the amount of cations other than proton on the desulfurization catalyst. Accordingly, the instant claimed invention is not considered to be patentably distinguished from the prior art of record.

26. Applicant submitted re-written results of the Examples and Comparative Examples with the arguments. Applicant argues that it is clear that the zeolite of claim 1 shows good performance in adsorptive desulfurization.

27. This argument is not found persuasive because the data relied upon in the table to demonstrate unexpected or improved results over the comparative examples are not commensurate in scope with the entire claimed ranges. Specifically, the $\text{SiO}_2/\text{Al}_2\text{O}_3$ molar ratio ranges from 5.5 to 27.4 and the cation mass content ranges from 0.02 to 3 mass %, both of which do not encompass the entirety of the ranges claimed in instant claim 1. It has been held that whether the unexpected results are the result of unexpectedly improved results or a property not taught by the prior art, the "objective evidence of nonobviousness must be commensurate in scope with the claims which the evidence is offered to support." In other words, the showing of unexpected results must be reviewed to see if the results occur over the entire claimed range. *In re Clemens*, 622 F.2d 1029, 1036, 206 USPQ 289, 296 (CCPA 1980), *In re Peterson*, 315 F.3d 1325, 1329-31, 65 USPQ2d 1379, 1382-85 (Fed. Cir. 2003), and *In re Grasselli*, 713 F.2d 731, 741, 218 USPQ 769, 777 (Fed. Cir. 1983).

28. Applicant argues that the present invention is an adsorption desulfurization which does not accompany hydration and thus, the mechanism of desulfurization in the invention is totally different from Imura.

29. This argument is not found persuasive because while Examiner agrees that the claimed process is directed to adsorptive desulfurization, the claim is not limited to *only* adsorptive desulfurization and thus does not exclude the possibility of a hydration step,

as interpreted by the claim language "comprising". The transitional term "comprising", which is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited elements or method steps. See, e.g., *Mars Inc. v. H.J. Heinz Co.*, 377 F.3d 1369, 1376, 71 USPQ2d 1837, 1843 (Fed. Cir. 2004).

Information Disclosure Statement

30. The IDS indicated in the previous Office action as not being considered because it did not include a concise explanation of relevance (dated 10/20/2006) corresponded to another application and was mistakenly placed in the file of the instant application. Accordingly, the IDS has been removed from the file of this application and both IDS documents submitted with this application (dated 7/19/2006 and 10/19/2006) have been considered by the Examiner.

Conclusion

31. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RENEE ROBINSON whose telephone number is (571)270-7371. The examiner can normally be reached on Monday through Thursday 7:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter Griffin can be reached on (571)272-1447. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. R./
Examiner, Art Unit 1797

/Walter D. Griffin/
Supervisory Patent Examiner,
Art Unit 1797